

$$s_{1,i} = \sum_{j \neq i} \max(0, \Delta - x_i y_i + x_i y_j)$$

$$s_{2,i} = \sum_{j \neq i} \max(0, \Delta - x_i y_i + x_j y_i)$$

$$J(\theta)_i = s_{1,i} + s_{2,i}$$

$$\frac{\partial J(\theta)}{\partial x_i} = \sum_{j \neq i} (y_j - y_i)(s_{1,i} > 0) - \sum_{j \neq i} (y_i)(s_{2,i} > 0) + \sum_{j \neq i} y_j (s_{2,j} > 0)$$

$$\frac{\partial J(\theta)}{\partial y_i} = \sum_{j \neq i} (x_j - x_i)(s_{2,i} > 0) - \sum_{j \neq i} (x_i)(s_{1,i} > 0) + \sum_{j \neq i} x_j (s_{1,j} > 0)$$